

REMARKS

Claims 1 through 20 were pending in the application when an Office Action was mailed June 5, 2003, with respect to the above-identified application. The Office Action indicated that the oath or declaration is defective in failing to point out the citizenship and the city and state or foreign country of residence of each inventor. The Office Action objected to the specification because the specification was stated to it introduce new matter into the disclosure. Further, the Office Action indicates that the Claims 1-4, 7, 14, and 17-20 are rejected under 35 U.S.C. § 103(a) as being anticipated by U.S. Patent No. 6,413,048 to Muylaert ("Muylaert"). In addition, Claims 8 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Muylaert. Lastly, Claims 5, 6, 9-13, and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Muylaert in view of U.S. Patent No. 4,859,148 to Hibyan ("Hibyan"). The Office Action was not made final.

Applicant includes a declaration which Applicant believes will correct any deficiencies that may have appeared in the previously-filed declaration. In addition, Applicant has amended the Specification to address the objection that new matter was introduced. Further, based on the following response, Applicant respectfully requests reconsideration and allowance of Claims 1-20.

Rejections Under § 103(a)

Claims 1-4, 7, 14, and 17-20

At the bottom of page 2 of the Office Action, the heading "Claim Rejections – 35 USC § 103" appeared, followed by a quotation on page 3 of 35 U.S.C. § 103(a). Paragraph 4 on page 3 indicates that "Claims 1-4, 7, 14 and 17-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Muylaert," but later on that page the Office Action states that "It would have been obvious to one of ordinary skill in the art at the time the invention was made to have made the

single elastomeric bearing into two components.” Accordingly, Applicant has responded to the rejection explained on pages 3 through 5 as an obviousness rejection. Applicant respectfully requests clarification from the Examiner if Applicant has misunderstood the nature of the rejection.

Claims 1-4, 7, 14, and 17-20 were rejected under 35 U.S.C. § 103(a) as being obvious in light of U.S. Patent No. 6,413,048 to Muylaert. The Office Action stated that Muylaert renders the Claims obvious by disclosing the following elements:

“a rotary aircraft fully articulated hub assembly comprising a hub center body (12) including a plurality of attachment sections (14), configured to receive a plurality of bearing assemblies, positioned about a periphery of the hub center body, a plurality of rotor assemblies (16) configured to receive a pair of bearing assemblies (20a, 20b) and a plurality of bearing assemblies each assembly including an outer housing having an outer surface and an inner surface, the outer surface (28a, 28b) configured to mechanically connect the bearing assembly to the attachment sections of the hub center body, the inner surface being configured to receive a taper conical elastomeric bearing element, each bearing element having an inner race and an outer race (42, 46), an axial pre-load being applied through the inboard bearing element and the outboard bearing element, the respective inner race bearing elements being configured to receive a portion of the rotor assemblies. (Column 3, lines 50-52)”

The Office Action stated that “[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to have made the single elastomeric bearing element into two components, since it would have been held that forming into two pieces an article which has formerly been once piece involves only routine skill in the art and is an obvious engineering choice,” citing In re Larson et al., 144 USPQ 347 and Howard v. Detroit Stove Works, 150 U.S. 164. Applicant respectfully traverses,

Applicant submits that a *prima facie* case of obviousness has not been made because Muylaert neither teaches nor suggests the claimed invention. Claim 1 includes “a tapered conical inboard bearing element disposed within the first section, a taper of the inboard bearing being inwardly directed; and, a tapered conical outboard bearing element disposed within the second section, a taper of the outboard bearing being inwardly directed in a direction that is

substantially directly opposed to the inboard bearing taper.” By contrast, Muylaert uses a single-bearing configuration. Claim 1’s inclusion of a “tapered conical inboard bearing element” and a “tapered conical outboard element” is neither taught nor suggested by Muylaert, and does not represent a situation where what had been a single part is now being made from two parts as a matter of an “obvious design choice,” but changes both how the force imparted on the rotor is channeled.

As described in the background of the application, using a single bearing element as disclosed by Muylaert results in the bearing preload being directed through the hub:

“Elastomeric conical bearings are commonly used in bearing assemblies for helicopter rotor systems to accommodate rotor motion. The bearing assemblies are axially preloaded to prevent the conical bearing elements from experiencing a resultant tensional load. Currently, mono-directional bearing elements are employed at each attachment site of the main rotor hub. FIGURE 1 depicts a view of a prior art articulated hub assembly 20a. The hub assembly 20a includes a tire bar 26 connected to a hub center body 22. The tie bar 26 is connected to the center body 22 in a similar manner as disclosed in FIG.1, however, the bearing assembly 30a is substantially different. The bearing assembly 30 includes a pair of conical bearing elements 52 contacting the journal 28 on the bearing’s inner surface 52 and the outer bearing surface is contained within an outer housing 42a. Each bearing element is a mono-directional single conical taper bearing having an elastomeric element 54 contained within. The conical bearings are arranged such that the apex of the conical elements extends radially outward from one another. The bearing arrangement yields a force couple that extends from one bearing to the other. The force couple yields a bearing pre-load path 43 extending through the hub center body 22.

The prior art design creates an extended force couple resulting in a bearing pre-load path extending through the main rotor hub center body. The hub center body must be designed to carry the extra loading. The extra design requirements add weight to the overall rotor hub reducing the aircraft’s load capacity and fuel efficiency.”

Page 2, lines 4 through 22. This discussion describes how a rotor structure having a single bearing receiving each journal such as Muylaert directs force imparted by the rotor on the housing through the journals. As shown in prior art FIGURE 1, the force is directed through the hub of the housing, and the hub has to account for the force thereby imposed.

Put another way, Muylaert creates a problem in that the rotor hub center body transfers the internal reaction of the preload force from the bearing assembly on one side to the bearing assembly engaging the journal on an opposing side of the rotor. Muylaert's bearing elements thus direct force to the hub, not away from it.

To the contrary, Claim 1 includes "a tapered conical inboard bearing element" and a tapered conical outboard bearing element" to receive each rotor journal. As a result, the hub is isolated from the force applied by the rotors. A hub employing the claimed invention can support a greater payload than a hub using conventional bearing systems. Because Muylaert does not teach or suggest Claim 1's "tapered conical inboard bearing element" and "tapered conical outboard bearing element," a *prima facie* case of obviousness has not been established. Thus, Applicant submits that Claim 1 is patentable over Muylaert and respectfully requests reconsideration and allowance of Claim 1.

Claim 14 (as amended) includes "a pair of taper conical elastomeric bearing elements, a taper of an outboard bearing element being inwardly directed in a direction that is substantially directly opposed to an inboard bearing taper." As previously described, "the pair of conical elastomeric bearing elements" so configured isolates the hub from the force directed on the rotor as opposed to directing force through the hub. Again, Muylaert's teaches a single bearing element design that directs force through the hub. Because Muylaert's single-bearing-element design does not teach using "a pair of taper conical elastomeric bearing elements," a *prima facie* case of obviousness has not been established. Thus, Applicant respectfully requests reconsideration and allowance of Claim 14.

Similarly, because Claims 2-4 and Claim 7 depend from and add additional limitations to patentable Claim 1, and, and Claims 17-20 depend from and add additional limitations to patentable Claim 14 (as amended), Applicant respectfully requests the Examiner also find that Claims 2-4, 7, and 17-20 are patentable over the applied reference.

Claims 8 and 15

Claims 8 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Muylaert. The Office Action stated that “[i]t would have been a matter of design choice to have chosen the appropriate axial pre-load depending on the designer’s choice.” Applicant respectfully traverses.

Applicant submits that a *prima facie* case of obviousness has not been made because Claims 8 and 15 include the limitations from independent Claims 1 and 14 from which they depend, respectively, and not all the claimed limitations of Claims 1 and 14 were taught or suggested by the applied reference. The pre-loading of the bearings applies to a configuration that is not taught or suggested by the prior art. As discussed above, Muylaert does not disclose or otherwise render obvious “a tapered conical inboard bearing element” and “a tapered conical outboard bearing element” included in Claim 1. Analogously, Muylaert does not teach or suggest “a pair of taper conical elastomeric bearing elements, a taper of an outboard bearing element being inwardly directed in a direction that is substantially directly opposed to an inboard bearing taper” included in Claim 7. Further, the Office Action conceded that “Muylaert does not teach wherein the axial pre-load is about 8,500 to 15,000 pounds” as recited in Claims 8 and 15. Thus, because of the dependency of Claims 8 and 15 and because the limitations thereby included are neither taught nor suggested by the prior art, Applicant respectfully contends that a *prima facie* case of obviousness has not been established. Respectfully, Applicant requests reconsideration and allowance of Claims 8 and 15.

Claims 5, 6, 9-13 and 16

Claims 5, 6, 9-13 and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Muylaert in view of Hibyan. Applicant respectfully traverses.

With regard to Claim 9, the Office Action stated that:

“Muylaert discloses a rotary aircraft opposed tapered conical elastomeric flap bearing assembly comprising an outer housing defining a first and a second section, the outer housing having an outer surface configured to attach a hub center body and an inner surface configured to receive a set of opposed taper conical bearing elements, a tapered conical inboard bearing element having an outer race and an inner race, the closed end plate defining a plurality of bores therethrough (best seen in Fig 5 at 40), a tapered conical outboard bearing element having an outer race and an inner race, the outer race being bonded to the inner surface of the outer housing and the inner race being frictionally engaged with the extended portion of the inner race of the inboard bearing element, the inner race of the outboard bearing element forming an outer plate defining a plurality of bores therethrough, wherein an axial pre-load is applied to the inboard bearing element and the outboard bearing element and at least one bearing coupler lug connecting the bearing elements.”

The Office Action concedes that “Muylaert does not teach wherein an outer surface of the outboard bearing element is bonded to an inner surface of the outer housing,” but maintains that “Hibyan teaches bonding bearing elements in a bearing assembly.” The Office Action concludes that “[i]t would have been obvious to have bonded the outer surface of the outboard bearing to an inner surface of the outer housing so as to provide greater strength to the overall assembly.” Applicant respectfully traverses.

Applicant submits that a *prima facie* case of obviousness has not been established because the combination of the applied references neither teaches nor suggests the claimed invention. As previously described, Muylaert employs a single-bearing-element structure. By contrast, Claim 9 (as amended) includes “a tapered conical outboard bearing element” with “a taper of the outboard bearing element being inwardly directed in a direction that is substantially directly opposed to the inboard bearing taper.” For reasons previously described in connection with independent Claims 1 and 14, the claimed invention is distinguishable from Muylaert. Furthermore, Hibyan does not overcome this deficiency of Muylaert. As the Examiner correctly notes, Hibyan teaches bonding bearing elements in a bearing assembly. However, Hibyan does not teach or suggest using “a tapered conical outboard bearing element . . . opposed to the inboard bearing taper.” Thus, the combination of the applied references does not present a *prima*

facie case of obvious. Applicant therefore respectfully requests reconsideration and allowance of Claim 9.

With regard to dependent Claims 5, 6, 10-13, and 16, the Office Action stated that Muylaert as modified by Hibyan to include bonding of bearing elements and, thus, the Claims are obvious. Respectfully, because of the dependency of Claims 5 and 6 from Claim 1, Claims 10-13 from Claim 9, and Claim 16 from Claim 14, the dependent claims add further limitations to patentable claims. Thus, a *prima facie* case of obviousness has not been established with regard to these dependent claims and the limitations included as a result of their dependency. Thus, Application respectfully requests reconsideration and allowance of dependent Claims 5, 6, 10-13, and 16.

CONCLUSION

In view of the above amendments and remarks, Applicant very respectfully submits that Claims 1-4, 7, 14 (as amended), and 17-20 are patentable over Muylaert. In addition, Claims 8 and 15 add further limitations to Claims 1 and 14, respectively, and thus are patentable over Muylaert. Also, Claim 9 (as amended) is patentable over Muylaert in view of Hibyan. Lastly, dependent Claims 5, 6, 10-13, and 16 depend from patentable claims and, thus, also are patentable over Muylaert in view of Hibyan. Applicant has amended the specification to overcome the objections set forth in the Office Action and has supplied a declaration to correct concerns with the previously-filed declaration.

Applicant very respectfully submits that all claims pending in this application are patentable over the cited references and are in condition for allowance. Applicant very respectfully requests entry of the Amendment, and reconsideration and allowance of all claims.

Respectfully submitted,

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